

-----Original Message-----

From: juergen.h.gerth@ca.abb.com [<mailto:juergen.h.gerth@ca.abb.com>]
Sent: Thursday, July 15, 2004 10:18 AM
To: Molina, Andres J.
Cc: ramsis.girgis@us.abb.com; scott.w.howard@us.abb.com
Subject: Noise calculation

Dear Andres,

I am sorry that we did not answer your question regarding the pure tone development of four transformers. I simply did not get that on the phone. Looking at the tables which are valid for one transformer we can see the following:

1. In the case of the no-load sound the 500 Hz octave band center frequency exceeds the 250 Hz and the 1000 Hz by more than 3 dB. Acc. to the definition given on the phone this is a pure tone case.
2. In the case of the total noise at 50% loading the 125 Hz and the 500 Hz center frequency reach the same value. There is no pure tone situation.
3. In the case of the total noise at 75% loading the 125 Hz center frequency exceeds all others by more than 3 dB. This again is a pure tone case.

In case of more than one transformer we have to add the noise components of the transformers frequency by frequency:

In case of two transformers we have to add 3 dB
In case of three transformers you have to add 4.8 dB
In case of four transformers you have to add 6 dB to each individual center frequency as well as to the total noise. The whole level goes up but the differences remain unchanged. This is the theoretical situation on paper. Practically the frequency spectra of different transformer- even if of the same design- will not be completely identical. I would expect that four transformers have less tendency to develop pure tones than one single unit

I hope this additional information answers your question completely.

regards Juergen

----- Forwarded by Juergen H Gerth/CAABB/ABB on 07/15/2004 08:34 AM ---
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07/13/2004 Juergen H Gerth/CAABB/ABB
04:57 PM Dept.: Administration, Phone: +1 450
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Internal

To: ANDRES.MOLINA@us.ngrid.com
cc: Ramsis
Girgis/StLouis/USTRA/ABB@ABB, Scott W
Howard/Field_Marketing/USTRA/ABB@ABB
Subject: Noise calculation

Dear Andres,

I am writing to confirm the main information on noise levels, given to you during today's conference call.

Transformers in operation generate noise coming from two sources:

1. The no-load noise caused by the flux in the core, which depends on the excitation and the service voltage. The no load noise frequently includes the noise of the fans. 2. The load noise caused by the current in the windings. The load noise depends on the loading of the transformer.

On recommendation of Scott Howard we took the 448 MVA transformer 345/132 kV manufactured at Varennes for National Grid (Sandy Pond) and calculated the no load noise at rated voltage as well as the load noise at different current ratings. The results are shown in the tables below:

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The no load noise is dominated by the 500 Hz component, the load noise is a pure 120 Hz frequency.

In case there are further questions do not hesitate to contact me.

regards

Juergen Gerth
(Technical Manager)